

Econ 431 (Games and Decisions) Syllabus

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Term: Fall, 2018

Time and Location: Tuesday/Thursday 12:30 PM-1:45 PM in McClelland Rm 128

Overview

This class provides an in-depth overview of game theory. By the conclusion of the term, the students will have an intuitive understanding of the building blocks of game theory, and will be able to analyze many different problems that exhibit a strategic setting. Game theory has many applications outside of Economics, such as to Biology (evolutionary game theory), Psychology (behavioral game theory), Computer Science, Mathematics, and other social sciences. Although the focus of the course will be on Economic applications of game theory, the knowledge of game theory provided by this course will be broad enough such that students who master the material can apply the concepts learned to many different scenarios.

The content of the class will be divided into three sections, which will form the basis for the three exams. The first part of the course will cover the basics of game theory, which includes game trees, strategic form, aspects of games, characterizations of games, strategies, backward induction, Nash equilibrium, subgame perfect equilibrium, rationality, and Mixed Strategy Nash Equilibrium. The second part of the course will focus on basic applications of game theory, including continuous games, bargaining, repeated games, and firm competition. The last section of the course will focus on games with hidden information, including Bayesian Nash equilibrium, perfect Bayesian equilibrium, pooling vs separating equilibrium, Bayes' rule, auctions, and communication games.

Throughout the course, mathematics will be very important, and so everyone is expected to know a small amount of Calculus and probability theory, as these are crucial to understanding many of the game theoretic models that will be covered. While game theory can be done without these tools, some of the models would suffer from oversimplification, and students who wish to do further studies in Economics will find these math skills invaluable.

Course Text

I have required the book “Strategy, an Introduction to Game Theory.” The text is necessary to do the homework in this course and is a nice reference outside of class. The notes from the in-class portion will not be provided in this class, so this book is a useful tool in case you are struggling and provides supplementary problems. At the end of the syllabus, I will include the relevant chapters from the text along with the material covered on a day. Other recommended books include “Games, Strategies, and Decision Making” by Joseph E. Harrington Jr. and “An Introduction to Game Theory” by Martin J. Osborne.

Attendance and class participation policies

Attendance is not required except on the first day of class and exam days, although it is heavily encouraged since notes are not provided outside of class. During class students are also encouraged to participate in activities and ask questions.

Homework

In this class, there will be four homework assignments due on August 30th, September 20th, October 25th, and November 20th. Each homework will be worth 5% of the overall grade. Homework is due before the start of class on the appropriate date. The primary purpose of the homework is to provide students with feedback about their understanding about the material prior to the tests. Homework may be completed in groups of 1-3 people. **Work completed in homeworks must be the work of the group that turns in the homework.** Homework must be turned in in class. Late homework emailed to Sean between the start of class on the due date and 24 hours after the due date will be accepted with 20% of that homework grade deducted as a penalty. Answer keys will be posted online for each homework 48 hours after they are due. In addition to the homework that is due, I will list additional recommended problems.

Project

In this class, each student will (either individually or in a group) complete a project, which is worth 20% of your total course grade. The purpose of this project is for each student to explore how game theory applies to the world around us. Each student will complete this project in a group of 1-3 people. On the day after the first midterm, we will decide on these groups.

The requirements for this project are as follows:

Each group will take a “situation” and create a simple, game theoretic model which that group will solve through. This situation can be a scene from a movie, a game, or a real-world scenario. Original thought should be the center of this idea, so you shouldn’t take an example directly from an example that I went over in class or from a paper that you find. Groups should push themselves to either write down a more

general model, or to look at different versions of the game they are analyzing. For example, writing down a prisoner's dilemma and solving just that will not earn you a good grade on the project. The situation that you pick should be inspired by what **you** are interested in. **This paper should be no less than 3 pages, double-spaced, with 12 pt font.** Instead of analyzing a model in this way, students can also choose to run an experiment in the class to test the predictions of game theory.

In this project, you should clearly outline what you are modeling and why it is interesting. You should then clearly define the model, meaning that you should write down the players, the strategy space, and the payoffs. You should also go through a simple example that gives a flavor of what the solution looks like, and you should conclude by discussing your predicted solution and how it ties in to the situation you are modeling.

Students who choose to run an experiment should still follow the same steps above, but should detail why it is they are running an experiment. In addition, students should detail the results of the experiment and why it matches or mismatches the theory.

I will show you multiple examples of the kinds of things I'm looking for in class. **This project will be due on November 27th.**

Grade Breakdown & Optional Final

At the final class of the semester, students can choose to opt out of the final. Students **must** sign a waiver in class on December 4th to not take the final. If a student fails to sign the waiver and fails to show up at the final, they will be given a grade of 0 on the final.

If a student chooses not to take the final, their course grade will be based on the following:

Homework (4)	20% (5% each)
Midterm 1	20%
Midterm 2	20%
Midterm 3	20%
Project	20%
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Total	100%

If a student chooses to take the final, their course grade will be based on the following:

Grade in the course before the final	66%
Grade on the final	33%
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Total	100%

Grades will be calculated based on a traditional scale (90-100=A, 80-90=B, etc. . .)

Grading and Exam Policy

The exams will take place in class on September 27th, November 1st, November 29th, and the optional final will be on December 7th from 1:00 PM to 3:00 PM. A student who needs to miss an exam must notify me as early as possible before the scheduled exam time, must have a qualified Dean's excuse, and must not have missed any other exam. Students who email me with a valid Dean's excuse will not make up the missed midterm, but will be required to take the final exam and will have the final exam weighted more heavily when the final grade is calculated. Students who fail to attend an exam without first notifying me with a Dean's excuse will be given a 0 on the exam.

Optional Final Exam

This course will have an optional final exam. **Students who do not wish to take the final must be present in class on December 4th to sign a waiver indicating that they wish to opt out of taking the final.** No other forms of opting out will be accepted. Students who do not opt out are assumed to be taking the final, and any student who chooses not to opt out and does not show up will receive a 0 on the final exam, which will then be factored into their grade.

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. In this class, please refrain from behavior that would distract others from learning.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Special Needs/Accommodations

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at <http://new.library.arizona.edu/research/citing/plagiarism>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

Office Hours and Email Policy

Office hours will be held by myself on Wednesday from 1:00PM to 2:00 PM in room 401A, and by my TA Rachel on Monday from 2:00PM to 3:00PM in room 401A. Generally, any email sent to me will receive a response within 24 hours.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Subject to Change Statement

All information in this Syllabus, outside of the grading and exam policy, is subject to change by the instructor with advance notice.

Schedule

Tuesday, August 21: Introduction, Syllabus overview, What is a game? Extensive Form.

Thursday, August 23: Description of a game (players, strategies, payoffs), Definition of a strategy, Backward Induction Equilibrium (BIE), Equilibrium Path.

Tuesday, August 28: Matrix Form, Nash Equilibrium, Best Response, 3-player games in matrix form, Information sets.

Thursday, August 30: **Homework 1 Due**, Information Sets, going from tree to matrix form, difference between NE and BIE in tree form games, Strict/Weak Dominance

Tuesday, September 4: Iterative Deletion of Strictly/Weakly Dominated Strategies (IDSDS/IDWDS), Rationalizability, Rational, Location Game

Thursday, September 6: Location Game continued, Subgame Perfect Equilibrium (SPE), Perfect/Imperfect Information.

Tuesday, September 11: Mixed Strategy Nash Equilibria (2 player games)

Thursday, September 13: Mixed Strategy Nash Equilibria (3 player games), Usage of Mixed Strategies in Dominance. 2/3 Beauty Contest. **End of Material for Exam #1**

Tuesday, September 18: **Start of material for exam 2**, Solving through Beauty Contest. Ultimatum Game.

Thursday, September 20: **Homework 2 Due**, NE and SPE in Ultimatum Game, Start of Firm Section, Competition in Price with Homogeneous Goods.

Tuesday, September 25: **Review #1**

Thursday, September 27: **Exam #1**

Tuesday, October 2: **Team Creation Day**, Going over team project (See document in D2L for details on project).

Thursday, October 4: Cournot with Homogeneous Goods, Bertrand with Heterogeneous Goods.

Tuesday, October 9: Stackelberg game. Start of repeated games.

Thursday, October 11: Finitely repeated games. Defining strategies in terms of the history of the game.

Tuesday, October 16: Infinitely repeated games, defining a strategy in terms of history, equivalent histories, one-shot deviation rule.

Thursday, October 18: Approximate end of material for Exam #2.

Tuesday, October 23: Start of incomplete information games. Nature. Bayesian Nash equilibria.

Thursday, October 25: **Homework #3 Due**, Finding Bayesian Nash equilibria, beliefs at information sets, problems with Bayesian Nash equilibria.

Tuesday, October 30: Project Discussion Day

Thursday, November 1: **Review #2**

Tuesday, November 6: **Exam #2**

Thursday, November 8: Perfect Bayesian Nash Equilibria, Bayes' Rule.

Tuesday, November 13: Separating/Pooling Bayesian Nash equilibria.

Thursday, November 15: Auctions (First price, second price, all-pay)

Tuesday, November 20: **Homework #4 Due**, Communication Games, End of material for Exam #3.

Thursday, November 22: Thanksgiving break!

Tuesday, November 27: **Project Due, Review #3**

Thursday, November 29: Exam #3

Tuesday, December 4: Final Day! Hand back projects and Exam #3 and sign final waiver.